

This listing of claims will replace all prior versions, and listings, of claims in the application:

1 Claim 1 (previously presented): A computer-implemented  
2 method comprising:  
3 a) accepting forwarding liveness status information  
4 of at least two different interfaces;  
5 b) composing an aggregated message including the  
6 forwarding liveness status information of the at  
7 least two different interfaces as data within the  
8 aggregated message; and  
9 c) sending the aggregated message towards a  
10 neighbor node.

1 Claim 2 (previously presented): The computer-implemented  
2 method of claim 1 further comprising:  
3 d) maintaining a first timer for tracking a send  
4 time interval, wherein the acts of composing the  
5 aggregated message and sending the aggregated  
6 message are performed after expiration of the first  
7 timer; and  
8 e) restarting the first timer after the aggregated  
9 message is sent.

1 Claim 3 (previously presented): The computer-implemented  
2 method of claim 2 wherein the aggregated message further  
3 includes a dead time interval, and wherein the send time  
4 interval is less than the dead time interval.

1 Claim 4 (previously presented): The computer-implemented  
2 method of claim 2 wherein the aggregated message further  
3 includes a dead time interval, and wherein the send time

4 interval is no more than one third of the dead time  
5 interval.

1 Claim 5 (previously presented): The computer-implemented  
2 method of claim 2 wherein the send time interval is less  
3 than one second.

1 Claim 6 (previously presented): The computer-implemented  
2 method of claim 2 wherein the send time interval is less  
3 than 100 msec.

1 Claim 7 (previously presented): The computer-implemented  
2 method of claim 1 wherein the aggregated message further  
3 includes a dead time interval.

1 Claim 8 (previously presented): The computer-implemented  
2 method of claim 1 wherein the act of sending the  
3 aggregated message includes providing the aggregated  
4 message in an Internet protocol packet.

1 Claim 9 (previously presented): The computer-implemented  
2 method of claim 8 wherein the aggregated message is sent  
3 towards the neighbor node by setting a destination  
4 address in the Internet protocol packet to a multicast  
5 address associated with routers that support aggregated  
6 interface forwarding liveness.

1 Claim 10 (previously presented): The  
2 computer-implemented method of claim 1 wherein the status  
3 information includes a forwarding liveness state selected  
4 from a group of forwarding liveness states consisting of  
5 (A) interface up, (B) interface down, (C) interface

6 monitor not reporting, and (D) forwarding engine  
7 restarting.

1 Claim 11 (previously presented): For use with a node, a  
2 computer-implemented method comprising:

- 3       a) receiving an aggregated message including  
4            i) forwarding liveness status information for  
5            a first set of at least two different  
6            interfaces as data within the aggregated  
7            message, and  
8            ii) a time interval; and  
9       b) updating neighbor node forwarding liveness  
10       status information using the aggregated message.

1 Claim 12 (previously presented): The  
2 computer-implemented method of claim 11 wherein the act  
3 of updating neighbor node liveness status information  
4 includes

- 5       i) setting a first timer to the time interval  
6       and starting the first timer,  
7       ii) if the first timer expires, setting a  
8       status of each of the at least two different  
9       interfaces of the neighbor node to down; and  
10       iii) if a further message, sourced from the  
11       neighbor node, and including  
12            A) forwarding liveness status  
13            information, and  
14            B) a new time interval,  
15       is received then, resetting the first timer to  
16       the new time interval and restarting the first  
17       timer.

1 Claim 13 (previously presented): The  
2 computer-implemented method of claim 12 wherein each of  
3 the time interval and the new time interval is less than  
4 one second.

1 Claim 14 (previously presented): The  
2 computer-implemented method of claim 11 wherein the  
3 forwarding liveness status information is interface  
4 forwarding liveness status information.

1 Claim 15 (previously presented): The  
2 computer-implemented method of claim 11 wherein the  
3 status information includes a forwarding liveness state  
4 selected from a group of forwarding liveness states  
5 consisting of (A) interface up, (B) interface down, (C)  
6 interface monitor not reporting, and (D) forwarding  
7 engine restarting.

1 Claim 16 (previously presented): The  
2 computer-implemented method of claim 11 wherein the  
3 forwarding liveness status information includes at least  
4 one of (i) the integrity and correct operation of  
5 forwarding tables, (ii) the integrity and correct  
6 operation of switch fabric, (iii) the integrity and  
7 correct operation of a forwarding lookup engine, (iv) the  
8 integrity and correct operation of a traffic scheduler,  
9 (v) the integrity and correct operation of a traffic  
10 classifier, (vi) the integrity and correct operation of  
11 buffers in the data plane, (vii) the integrity and  
12 correct operation of packet segmentation modules, (viii)  
13 the integrity and correct operation of packet reassembly  
14 modules, (ix) the integrity and correct operation of

15 packet re-sequencing modules, (x) whether or not a node  
16 is restarting, (xi) whether or not the forwarding plane  
17 is congested, or (xii) the integrity and correct  
18 operation of fragmentation modules.

1 Claim 17 (previously presented): The  
2 computer-implemented method of claim 11 wherein the  
3 forwarding liveness status information includes at least  
4 one of (i) bit error rate at a link interface, and (ii)  
5 clock synchronization at a link interface.

1 Claim 18 (previously presented): A computer-implemented  
2 method for monitoring interface forwarding liveness, the  
3 method comprising:  
4 a) determining, at a first node, forwarding  
5 liveness status information for at least two  
6 different interfaces;  
7 b) sending, from the first node, an aggregated  
8 message including the determined status information  
9 for the at least two different interfaces as data  
10 within the aggregated message;  
11 c) receiving, at the second node, the aggregated  
12 message; and  
13 d) updating, by the second node, first node  
14 forwarding liveness status information using the  
15 aggregated message.

1 Claim 19 (previously presented): The  
2 computer-implemented method of claim 18 wherein the  
3 aggregated message further includes a dead interval, and  
4 wherein the act of updating first node forwarding  
5 liveness status information includes

6 i) setting a timer to the dead interval;  
7 ii) starting the timer;  
8 iii) determining whether or not a further  
9 message including forwarding liveness status  
10 information is received from the first node  
11 before the expiration of the timer; and  
12 iv) if it is determined that a further message  
13 including forwarding liveness status  
14 information is not received from the first node  
15 by the second node before the expiration of the  
16 timer, then informing the second node that the  
17 at least two different interfaces of the first  
18 node are down.

1 Claim 20 (previously presented): The  
2 computer-implemented method of claim 18 wherein the  
3 status information includes a forwarding liveness state  
4 selected from a group of forwarding liveness states  
5 consisting of (A) interface up, (B) interface down, (C)  
6 interface monitor not reporting, and (D) forwarding  
7 engine restarting.

1 Claim 21 (previously presented): The  
2 computer-implemented method of claim 18 wherein the  
3 forwarding liveness status information includes at least  
4 one of (i) the integrity and correct operation of  
5 forwarding tables, (ii) the integrity and correct  
6 operation of switch fabric, (iii) the integrity and  
7 correct operation of a forwarding lookup engine, (iv) the  
8 integrity and correct operation of a traffic scheduler,  
9 (v) the integrity and correct operation of a traffic  
10 classifier, (vi) the integrity and correct operation of

11 buffers in the data plane, (vii) the integrity and  
12 correct operation of packet segmentation modules, (viii)  
13 the integrity and correct operation of packet reassembly  
14 modules, (ix) the integrity and correct operation of  
15 packet re-sequencing modules, (x) whether or not a node  
16 is restarting, (xi) whether or not the forwarding plane  
17 is congested, or (xii) the integrity and correct  
18 operation of fragmentation modules.

1 Claim 22 (previously presented): The  
2 computer-implemented method of claim 18 wherein the  
3 forwarding liveness status information includes at least  
4 one of (i) bit error rate at a link interface, and (ii)  
5 clock synchronization at a link interface.

Claims 23-28 (canceled)

1 Claim 29 (previously presented): For use with a node,  
2 apparatus comprising:  
3 a) one or more processors;  
4 b) at least one input device; and  
5 c) one or more storage devices storing  
6 processor-executable instructions which, when  
7 executed by one or more processors, perform a method  
8 of:  
9 i) accepting forwarding liveness status  
10 information of at least two different  
11 interfaces;  
12 ii) composing an aggregated message including  
13 the forwarding liveness status information of  
14 the at least two different interfaces as data  
15 within the aggregated message; and

16                   iii) sending the aggregated message towards a  
17                   neighbor node.

1    Claim 30 (previously presented): The apparatus of claim  
2    29 further comprising:

3                   iv) maintaining a first timer for tracking a  
4                   send time interval, wherein the act of  
5                   composing the aggregated message and sending  
6                   the aggregated message compose and send the  
7                   aggregated message after expiration of the  
8                   first timer; and  
9                   v) restarting the first timer after the  
10                  aggregated message is sent.

1    Claim 31 (previously presented): The apparatus of claim  
2    30 wherein the aggregated message further includes a dead  
3    time interval, and wherein the send time interval is less  
4    than the dead time interval.

1    Claim 32 (previously presented): The apparatus of claim  
2    30 wherein the aggregated message further includes a dead  
3    time interval, and wherein the send time interval is no  
4    more than one third of the dead time interval.

1    Claim 33 (previously presented): The apparatus of claim  
2    30 wherein the send time interval is less than one  
3    second.

1    Claim 34 (previously presented): The apparatus of claim  
2    30 wherein the send time interval is less than 100 msec.



1 Claim 35 (previously presented): The apparatus of claim  
2 29 wherein the aggregated message further includes a dead  
3 time interval.

1 Claim 36 (previously presented): The apparatus of claim  
2 29 wherein the act of sending the aggregated message  
3 includes providing the aggregated message in an Internet  
4 protocol packet.

1 Claim 37 (previously presented): The apparatus of claim  
2 36 wherein the act of sending the aggregated message  
3 includes setting a destination address in the Internet  
4 protocol packet to a multicast address associated with  
5 routers that support interface forwarding liveness.

1 Claim 38 (previously presented): The apparatus of claim  
2 29 wherein the status information includes a forwarding  
3 liveness state selected from a group of forwarding  
4 liveness states consisting of (A) interface up, (B)  
5 interface down, (C) interface monitor not reporting, and  
6 (D) forwarding engine restarting.

1 Claim 39 (previously presented): For use with a node,  
2 apparatus comprising:  
3 a) one or more processors;  
4 b) at least one input device; and  
5 c) one or more storage devices storing  
6 processor-executable instructions which, when  
7 executed by one or more processors, perform a method  
8 of:  
9 i) receiving an aggregated message including

10                   A) forwarding liveness status information  
11                   for a first set of at least two different  
12                   interfaces as data within the aggregated  
13                   message, and  
14                   B) a time interval; and  
15           ii) updating neighbor node forwarding liveness  
16           status information using the aggregated  
17           message.

1   Claim 40 (previously presented): The apparatus of claim  
2   39 wherein the act of updating neighbor node liveness  
3   status information includes  
4           A) setting a first timer to the time  
5           interval and starting the first timer,  
6           B) setting a status of each of the at  
7           least two different interfaces of the  
8           neighbor node to down if the first timer  
9           expires; and  
10          C) if a further message, sourced from the  
11          neighbor node, and including  
12              1) forwarding liveness status  
13              information, and  
14              2) a new time interval,  
15          is received, resetting the first timer to  
16          the new time interval and restarting the  
17          first timer.

1   Claim 41 (previously presented): The apparatus of claim  
2   39 wherein each of the time interval and the new time  
3   interval is less than one second.

1 Claim 42 (previously presented): The apparatus of claim  
2 39 wherein the forwarding liveness status information is  
3 interface forwarding liveness status information.

1 Claim 43 (previously presented): The apparatus of claim  
2 39 wherein the status information includes a forwarding  
3 liveness state selected from a group of forwarding  
4 liveness states consisting of (A) interface up, (B)  
5 interface down, (C) interface monitor not reporting, and  
6 (D) forwarding engine restarting.

1 Claim 44 (previously presented): The apparatus of claim  
2 39 wherein the forwarding liveness status information  
3 includes at least one of (i) the integrity and correct  
4 operation of forwarding tables, (ii) the integrity and  
5 correct operation of switch fabric, (iii) the integrity  
6 and correct operation of a forwarding lookup engine, (iv)  
7 the integrity and correct operation of a traffic  
8 scheduler, (v) the integrity and correct operation of a  
9 traffic classifier, (vi) the integrity and correct  
10 operation of buffers in the data plane, (vii) the  
11 integrity and correct operation of packet segmentation  
12 modules, (viii) the integrity and correct operation of  
13 packet reassembly modules, (ix) the integrity and correct  
14 operation of packet re-sequencing modules, (x) whether or  
15 not a node is restarting, (xi) whether or not the  
16 forwarding plane is congested, or (xii) the integrity and  
17 correct operation of fragmentation modules.

1 Claim 45 (previously presented): The apparatus of claim  
2 39 wherein the forwarding liveness status information  
3 includes at least one of (i) bit error rate at a link

4 interface, and (ii) clock synchronization at a link  
5 interface.

1 Claim 46 (previously presented): A system comprising:

2 a) a first node including

3 i) one or more processors;  
4 ii) at least one input device; and  
5 iii) one or more storage devices storing  
6 processor-executable instructions which, when  
7 executed by one or more processors, perform a  
8 method of:

9 A) determining, at a first node,  
10 forwarding liveness status information for  
11 at least two different interfaces, and  
12 B) sending an aggregated message  
13 including the determined status  
14 information for the at least two different  
15 interfaces as data within the aggregated  
16 message; and

17 b) a second node including

18 i) one or more processors;  
19 ii) at least one input device; and  
20 iii) one or more storage devices storing  
21 processor-executable instructions which, when  
22 executed by one or more processors, perform a  
23 method of:

24 A) receiving the aggregated message, and  
25 B) updating first node forwarding liveness  
26 status information using the aggregated  
27 message.

1 Claim 47 (previously presented): The system of claim 46  
2 wherein the aggregated message further includes a dead  
3 interval, and wherein the act of updating first node  
4 forwarding liveness status information includes  
5 i) setting a timer to the dead interval;  
6 ii) starting the timer;  
7 iii) determining whether or not a further  
8 message including forwarding liveness status  
9 information is received from the first node  
10 before the expiration of the timer; and  
11 iv) informing the second node that the at  
12 least two different interfaces of the first  
13 node are down if it is determined that a  
14 further message including forwarding liveness  
15 status information is not received from the  
16 first node by the second node before the  
17 expiration of the timer.

1 Claim 48 (previously presented): The system of claim 46  
2 wherein the status information includes a forwarding  
3 liveness state selected from a group of forwarding  
4 liveness states consisting of (A) interface up, (B)  
5 interface down, (C) interface monitor not reporting, and  
6 (D) forwarding engine restarting.

1 Claim 49 (previously presented): The system of claim 46  
2 wherein the forwarding liveness status information  
3 includes at least one of (i) the integrity and correct  
4 operation of forwarding tables, (ii) the integrity and  
5 correct operation of switch fabric, (iii) the integrity  
6 and correct operation of a forwarding lookup engine, (iv)  
7 the integrity and correct operation of a traffic

8 scheduler, (v) the integrity and correct operation of a  
9 traffic classifier, (vi) the integrity and correct  
10 operation of buffers in the data plane, (vii) the  
11 integrity and correct operation of packet segmentation  
12 modules, (viii) the integrity and correct operation of  
13 packet reassembly modules, (ix) the integrity and correct  
14 operation of packet re-sequencing modules, (x) whether or  
15 not a node is restarting, (xi) whether or not the  
16 forwarding plane is congested, or (xii) the integrity and  
17 correct operation of fragmentation modules.

1 Claim 50 (original): The system of claim 46 wherein the  
2 forwarding liveness status information includes at least  
3 one of (i) bit error rate at a link interface, and (ii)  
4 clock synchronization at a link interface.

1 Claim 51 (previously presented): The  
2 computer-implemented method of claim 1 wherein the  
3 forwarding liveness status information of at least one of  
4 the at least two different interfaces included in the  
5 aggregated message includes a forwarding liveness state  
6 set to interface monitor not reporting.

1 Claim 52 (previously presented): The  
2 computer-implemented method of claim 1 wherein the  
3 forwarding liveness status information of at least one of  
4 the at least two different interfaces included in the  
5 aggregated message includes a forwarding liveness state  
6 set to forwarding engine restarting.

1 Claim 53 (currently amended): The computer-implemented  
2 method of claim 12 ~~[[29]]~~ wherein the forwarding liveness

3 status information of at least one of the at least two  
4 different interfaces included in the first set of at  
5 least two different interfaces included within the  
6 aggregated message includes a forwarding liveness state  
7 set to interface monitor not reporting.

1 Claim 54 (currently amended): The computer-implemented  
2 method of claim 12 ~~[[29]]~~ wherein the forwarding liveness  
3 status information of at least one of the at least two  
4 different interfaces included in the first set of at  
5 least two different interfaces included within the  
6 aggregated message includes a forwarding liveness state  
7 set to forwarding engine restarting.